

WHAT IS CLAIMED IS:

1. A power converter comprising  
a power module having  
a power controlling semiconductor element disposed  
5 on the conductive member with an insulation member  
interposed and  
a current detector for detecting current which is  
inputted into said power controlling semiconductor  
element or outputted from said power controlling  
10 semiconductor element; and  
a control unit for controlling operation of said power  
controlling semiconductor element, wherein  
said current detector has  
a conductor which is electrically connected to  
15 said power controlling semiconductor element, is  
disposed on said conductive member with an insulation  
member interposed, and has a portion relative distance  
of which to said conductive member is larger than  
relative distance between the laminated portion  
20 laminated on said conductive member with said  
insulation member interposed and the conductive  
member; and  
a magnetic detecting unit which is disposed in  
said conductor portion or in the vicinity of said  
25 conductor portion relative distance of which to said

conductive member is larger than relative distance  
between said conductor portion laminated on the  
conductive member with the insulation member  
interposed and said conductive member, and has a  
5 magnetic detecting semiconductor element which is  
electrically connected to said control unit.

2. A power converter according to claim 1,  
wherein

relative distance between said conductor portion  
10 equipped with said magnetic detecting unit or disposed  
in the vicinity of said magnetic detecting unit and  
said conductive member is larger than relative  
distance between said power controlling semiconductor  
element and said conductive member.

15 3. A power converter according to claim 1,  
wherein

said conductor portion relative distance of which  
to said conductive member is larger than relative  
distance between said conductor portion laminated on  
20 said conductive member with the insulation member  
interposed and said conductive member protrudes in the  
direction further away from said conductive member  
than said conductor portion laminated on said  
conductive member with said insulation member  
25 interposed.

4. A power converter according to claim 1,  
wherein

a portion of said conductive member that  
corresponds to said conductor portion relative  
5 distance of which to said conductive member is larger  
than relative distance between said conductor portion  
laminated on the conductive member with the insulation  
member interposed and said conductive member is  
thinner than the other portion.

10 5. A power converter according to claim 1,  
wherein

said magnetic detecting unit is disposed in said  
conductor portion or in the vicinity of said conductor  
portion relative distance of which to said conductive  
15 member is larger than relative distance between said  
conductor portion laminated on said conductive member  
with the insulation member interposed and said  
conductive member so that said magnetic detecting unit  
detects magnetic flux having a component parallel to  
20 said conductive member or to induction current flowing  
through said conductive member among magnetic flux  
generated by said conductor portion relative distance  
of which to said conductive member is larger than  
relative distance between said conductor portion  
25 laminated on said conductive member with the

insulation member interposed and said conductive member.

6. A power converter according to claim 1, wherein

5        said magnetic detecting unit is disposed in said conductor portion or in the vicinity of said conductor portion relative distance of which to said conductive member is larger than relative distance between said conductor portion laminated on said conductive member with the insulation member interposed and said  
10        conductive member so that said magnetic detecting unit detects magnetic flux having a component parallel to the perpendicular line which vertically intersects with said conductive member among magnetic flux  
15        generated by said conductor portion relative distance of which to said conductive member is larger than relative distance between said conductor portion laminated on said conductive member with the insulation member interposed and said conductive  
20        member.

7. A power converter according to claim 1, wherein

      said conductor portion relative distance of which to said conductive member is larger than relative  
25        distance between said conductor portion laminated on

said conductive member with the insulation member interposed and said conductive member has a portion which is vertical to said conductive member and extends in the direction away from said conductive member, and

5       said magnetic detecting unit is disposed in said conductor portion which is vertical to said conductive member and extends in the direction away from said conductive member so that the surface of the magnetic  
10       detection surface of the said magnetic detecting semiconductor element is vertical to said conductive member and said conductor portion which extends in the direction away from said conductive member and  
15       parallel to said conductor portion which extends in the direction away from said conductive member.

8. A power converter according to claim 1, wherein

20       said conductor portion relative distance of which to said conductive member is larger than relative distance between said conductor portion laminated on said conductive member with the insulation member interposed and said conductive member has a portion which extends parallel to said conductive member, and

25       said magnetic detecting unit is disposed in said conductor portion which extends parallel to said

conductive member so that the magnetic detection surface of said magnetic detecting semiconductor element is vertical and parallel to said conductor portion which extends parallel to said conductive member.

5

9. A power converter comprising  
a power module having  
a power controlling semiconductor element electrically connected to a load or an electric power supply means via a conductor,

10

a control unit for controlling operation of said power controlling semiconductor element, and

a current detector disposed in said conductor, wherein

15

said current detector has a magnetic detecting unit which is configured such that a magnetic detecting semiconductor element and a part of a connecting conductor which electrically connects said magnetic detecting semiconductor element with said control unit are encased in resin, and

20

at least a part of said magnetic detecting unit is contained in a depression created in said conductor.

10. A power converter according to claim 9, wherein

25

said conductor is an out-going electrode of said

terminal block in which the wire electrically  
connected to said load or said electric power supply  
means electrically connects an electrode of a terminal  
block which is electrically connected by tightening a  
5 screw with said power module or said control unit, and  
said depression is provided in said out-going  
electrode.

11. A power converter comprising  
a power module having  
10 a power controlling semiconductor element, and  
a current detector for detecting current which is  
inputted into said power controlling semiconductor  
element or outputted from said power controlling  
semiconductor element;

15 a control unit for controlling operation of said  
power controlling semiconductor element; and

a conductive member through which induction  
current flows due to electromagnetic induction  
generated by current flowing through said current  
20 detector, wherein

said current detector has  
a conductor electrically connected to said power  
controlling semiconductor element, and

a magnetic detecting unit which is disposed in  
25 said conductor or in the vicinity of said conductor

and has a magnetic detecting semiconductor element  
which is electrically connected to said control unit;  
and

among magnetic flux generated by said conductor,  
5        said magnetic detecting unit detecting magnetic  
flux having a component parallel to said conductive  
member or to said induction current flowing through  
said conductive member.

12. A power converter according to claim 11,  
10        wherein

said conductor has a portion extends in the  
direction away from said conductive member, and  
among magnetic flux generated by said conductor  
portion which extends in the direction away from said  
15        conductive member,

said magnetic detecting unit detects magnetic flux  
having a component parallel to said conductive member  
or to said induction current flowing through said  
conductive member.

20        13. A power converter according to claim 11,  
wherein

said conductor has a portion which is vertical to  
said conductive member and extends in the direction  
away from said conductive member, and

25        said magnetic detecting unit is disposed in said



conductor portion which is vertical to said conductive member and extends in the direction away from said conductive member so that the magnetic detection surface of said magnetic detecting semiconductor element is vertical to said conductive member and said conductor portion extends in the direction away from said conductive member and parallel to said conductor portion which extends in the direction away from said conductive member.

10           14. A power converter according to claim 11, wherein

          said conductor extends parallel to said conductive member and has at least first and second bend, and

          among magnetic flux generated said conductor  
15       portion located between said first bend and said second bend,

          said magnetic detecting unit detects magnetic flux having a component parallel to said conductive member or to induction current flowing through said  
20       conductive member.

          15. A power converter according to claim 11, wherein

          said conductor extends parallel to said conductive member and

25           has at least first and second bend; and

said magnetic detecting unit is disposed in said conductor portion located between said first bend and said second bend so that the magnetic detection surface of said magnetic detecting semiconductor element is vertical to said conductor portion located between said first bend and said second bend and said conductive member and parallel to said conductor portion located between said first bend and said second bend.

16. A power converter comprising  
a power module having  
a power controlling semiconductor element and  
a current detector for detecting current inputted into said power controlling semiconductor element or outputted from said power controlling semiconductor element;

a control unit for controlling operation of said power controlling semiconductor element; and

a conductive member through which induction current flows due to electromagnetic induction generated by current flowing through said current detector, wherein

said current detector has

a conductor which is electrically connected to said power controlling semiconductor element, extends

parallel to said conductive member, and has at least first and second bend; and

5 a magnetic detecting unit which is disposed in said conductor portion located between said first bend and said second bend or in the vicinity of said conductor portion and has a magnetic detecting semiconductor element which is electrically connected to said control unit; and among magnetic flux generated by said conductor portion located between  
10 said first bend and said second bend, said magnetic detecting unit detecting magnetic flux having a component parallel to said conductive member or to said induction current flowing through said conductive member.

15 17. A power converter according to claim 16, wherein

said conductor consists of a first conductor which is said conductor portion located between said first bend and said second bend, a second conductor which  
20 extends from said first conductor and bends at said first bend, and a third conductor which extends from said first conductor and bends at said second bend, and

among magnetic flux generated by said first  
25 conductor,

said magnetic detecting unit detects magnetic flux having a component parallel to said conductive member or said induction current flowing through said conductive member.

5           18. A power converter according to claim 16, wherein

            said conductor consists of a first conductor which is said conductor portion located between said first bend and said second bend, a second conductor which  
10           extends from said first conductor and bends at said first bend, and a third conductor which extends from said first conductor and bends at said second bend, and

            said magnetic detecting unit is disposed in said  
15           first conductor so that the magnetic detection surface of said magnetic detecting semiconductor element is vertical to said first conductor and said conductive member and parallel to said first conductor.

            19. A power converter comprising  
20           a power module having  
            a power controlling semiconductor element, and  
            a current detector for detecting current inputted into said power controlling semiconductor element or  
            outputted from said power controlling semiconductor  
25           element;

a control unit for controlling operation of said power controlling semiconductor element; and

a conductive member through which induction current flows due to electromagnetic induction generated by current flowing through said current  
5 detector, wherein

said current detector has

a conductor which is electrically connected to said power controlling semiconductor element and has  
10 at least first and second bend, and

a magnetic detecting unit which is disposed in said conductor portion located between said first bend and said second bend or in the vicinity of said conductor portion and has a magnetic detecting  
15 semiconductor element which is electrically connected to said control unit, and

among magnetic flux generated by said conductor portion located between said first bend and said second bend,

20 said magnetic detecting unit detecting magnetic flux having a component parallel to said conductive member or said induction current flowing through said conductive member.

20. A power converter according to claim 19,  
25 wherein

said conductor is said conductor portion located between said first bend and said second bend and consists of a first conductor which extends vertical to said conductive member, a second conductor which  
5 extends from said first conductor and bends at said first bend, and a third conductor which extends from said first conductor and bends at said second bend, and

among magnetic flux generated by said first  
10 conductor,

said magnetic detecting unit detects magnetic flux having a component parallel to said conductive member or said induction current flowing through said conductive member.

15 21. A power converter according to claim 20, wherein

said second conductor and said third conductor have a right angle to said first conductor and extend in different directions.

20 22. A power converter according to claim 21, wherein

said second conductor and said third conductor extend in the opposite directions.

25 23. A power converter according to claim 22,

wherein

said magnetic detecting unit is disposed on the plane such that the magnetic detection surface of said magnetic detecting semiconductor element is vertical to said second conductor and said third conductor using said first conductor's axis as an intersecting point so that among magnetic flux generated by said first conductor, said magnetic detecting semiconductor element detects magnetic flux having a component parallel to said conductive member or said induction current flowing through said conductive member.

24. A power converter according to claim 21, wherein

said third conductor extends in the direction at an obtuse angle (i.e.  $\theta$  is more than 90 degrees and less than 180 degrees) with said second conductor.

25. A power converter according to claim 24, wherein

said magnetic detecting unit is disposed in the space in which the magnetic detection surface of said magnetic detecting semiconductor element is segmented by the plane vertical to said second conductor using the first bend as an intersecting point and in the space which is located on said third conductor side including said first conductor so that said magnetic

detecting semiconductor element detects magnetic flux  
having a component parallel to said conductive member  
or said induction current flowing through said  
conductive member among magnetic flux generated by  
5 said first conductor.

26. A power converter according to claim 24,  
wherein

said magnetic detecting unit is disposed in the  
space in which the magnetic detection surface of said  
10 magnetic detecting semiconductor element is segmented  
by the plane vertical to said second conductor using  
the first bend as an intersecting point, and in the  
space which is located on said third conductor side  
including said first conductor and is segmented by the  
15 plane vertical to said third conductor using said  
second bend as an intersecting point, and also in the  
space which overlaps with the space located on said  
second conductor side including said first conductor  
so that said magnetic detecting semiconductor element  
20 detects magnetic flux having a component parallel to  
said conductive member or said induction current  
flowing through said conductive member among magnetic  
flux generated by said first conductor.

27. A power converter comprising  
25 a power module having



a power controlling semiconductor element, and  
a current detector for detecting current inputted  
into said power controlling semiconductor element or  
outputted from said power controlling semiconductor  
5 element;

a control unit for controlling operation of said  
power controlling semiconductor element; and

a conductive member through which induction  
current flows due to electromagnetic induction  
10 generated by current flowing through said current  
detector, wherein

said current detector has

a conductor electrically connected to said power  
controlling semiconductor element, and

15 a magnetic detecting unit which is disposed in  
said conductor or in the vicinity of said conductor  
and has a magnetic detecting semiconductor element  
which is electrically connected to said control unit,  
and

20 among magnetic flux generated by said conductor,  
said magnetic detecting unit detecting magnetic  
flux having a component parallel to the perpendicular  
line which vertically intersects with said conductive  
member.

25 28. A power converter according to claim 27,

wherein

said conductor has a portion which protrudes in the direction away from said conductive member, and among magnetic flux generated by said conductor  
5 portion protruding in the direction away from said conductive member; and

said magnetic detecting unit detects magnetic flux having a component parallel to the perpendicular line which vertically intersects with said conductive  
10 member.

29. A power converter according to claim 27,  
wherein

said conductor has a portion which protrudes in  
15 the direction away from said conductive member and is parallel to said conductive member; and

said magnetic detecting unit is disposed in said conductor portion which protrudes in the direction away from said conductive member and is parallel to  
20 said conductive member so that the magnetic detection surface of said magnetic detecting semiconductor element is parallel to said conductive member and is vertical and parallel to said conductor portion which protrudes in the direction away from said conductive  
25 member and is parallel to said conductive member.

30. An electric power system for converting electric power supplied by an electric power supply means into prescribed electric power by a power converter and supplying the power to a load, wherein a power converter according to claim 1 is used as said power converter.

31. An electric power system for converting electric power supplied by an electric power supply means into prescribed electric power by a power converter and supplying the power to a load, wherein a power converter according to claim 9 is used as said power converter.

32. An electric power system for converting electric power supplied by an electric power supply means into prescribed electric power by a power converter and supplying the power to a load, wherein a power converter according to claim 11 is used as said power converter.

33. An electric power system for converting electric power supplied by an electric power supply means into prescribed electric power by a power converter and supplying the power to a load, wherein a power converter according to claim 16 is used as said power converter.

34. An electric power system for converting

electric power supplied by an electric power supply means into prescribed electric power by a power converter and supplying the power to a load, wherein a power converter according to claim 19 is used as said power converter.

35. An electric power system for converting electric power supplied by an electric power supply means into prescribed electric power by a power converter and supplying the power to a load, wherein a power converter according to claim 27 is used as said power converter.

36. A mobile body comprising:  
a body;  
a driven device provided in said body;  
a motor for being driven by an external power source or electric power supplied from an internal power source mounted to said body thereby driving said driven device; and

a power converter for controlling electric power supplied from said power source to said motor, wherein a power converter according to claim 1 is used as said power converter.

37. A mobile body comprising:  
a body;  
a driven device provided in said body;

a motor for being driven by an external power source or electric power supplied from an internal power source mounted to said body thereby driving said driven device; and

5 a power converter for controlling electric power supplied from said power source to said motor, wherein a power converter according to claim 9 is used as said power converter.

38. A mobile body comprising:

10 a body;

a driven device provided in said body;

a motor for being driven by an external power source or electric power supplied from an internal power source mounted to said body thereby driving said  
15 driven device; and

a power converter for controlling electric power supplied from said power source to said motor, wherein a power converter according to claim 11 is used as said power converter.

20 39. A mobile body comprising:

a body;

a driven device provided in said body;

a motor for being driven by an external power source or electric power supplied from an internal  
25 power source mounted to said body thereby driving said

driven device; and

a power converter for controlling electric power  
supplied from said power source to said motor, wherein  
a power converter according to claim 16 is used as  
5 said power converter.

40. A mobile body comprising :

a body;

a driven device provided in said body;

a motor for being driven by an external power  
10 source or electric power supplied from an internal  
power source mounted to said body thereby driving said  
driven device; and

a power converter for controlling electric power  
supplied from said power source to said motor, wherein  
15 a power converter according to claim 19 is used as  
said power converter.

41. A mobile body comprising:

a body;

a driven device provided in said body;

20 a motor for being driven by an external power  
source or electric power supplied from an internal  
power source mounted to said body thereby driving said  
driven device; and

a power converter for controlling electric power  
25 supplied from said power source to said motor, wherein

a power converter according to claim 27 is used as  
said power converter.